STUDIES ON CATALASE ACTIVITY IN ALMOND SEEDS

by

J. P. MIHÁLYFI

Department of Plant Physiology of the Eötvös Loránd University, Budapest

Received on September 20th, 1966

Synopsis

Catalase activity in dry, soaked and germinating almond seeds was examined. Concentration of enzymatic inhibitors in the seeds was found to be the main factor of heterogeneity observed in the catalase activity of almond seeds. Soaking of the seeds resulted in a decrease of catalase activity. In germinating almond seeds catalase activity exhibited a substantial increase after an initial decrease, and then again showed a decreasing tendency.

Introduction

In examining the alteration of catalase activity during germination, several authors, including L'Lamas (1954), have found that the activity of the enzyme increases during germination and then decreases. According to the data of Lubtchenko (1959) the catalase activity in the endospermium of *Tilia cordata* and *Evonymus europaea* increases during stratification. In *Evonymus*, if stratification is not permanent enough, catalase activity does not reach the value required for germination. Hori and Nakamuhara (1953) have examined the activity of catalase in *Vicia faba* during germination. The enzyme activity of the embryo was rising rapidly and, after a maximum reached on the second day, subsequently decreased. In the cotyledons, catalase was the most active on the fifth day and here too the enzyme activity decreased afterwards.

From the physiological viewpoint, the fruits and particularly the stone-fruits have been comparatively little studied. The purpose of the present paper is to contribute to the study of this question.

Materials and Method

Equidimensional cylindrical samples were taken from the cotyledons of cleaned and shelled almond seeds. The catalase activity of dry, soaked and germinating almond seeds was determined by using the gasometric method of

F r e n y ó (1962). Enzymic activity was displayed by the open surface of the sample. The volume of oxygen released in 1 minute from a 1% solution of hydrogen peroxide was measured. Since, with regard to catalase activity, almond stones even if originating from the same tree are rather heterogeneous, the alteration of enzyme activity was studied in the average of 10 to 25 data.

In an attempt to find out the reason for the significant individual differences, the catalase activity of seeds grouped according to their content in bitter substance was examined. Classification was accomplished by means of simple tasting.

Sweet almond seeds were soaked in thermos flasks at temperatures of 20°C, 30°C and 40°C, respectively.

Next, cleaned sweet almond seeds were germinated on filter-paper. The alteration of catalase activity was recorded during the first 15 days.

The catalase activity of germinating sweet and bitter almond seeds was compared in the first week of germination.

The data are presented a) in case of dry seeds of various tastes, in the percentage of the enzyme activity of sweet seeds, and b) in case of soaked and germinating seeds, in the percentage of the catalase activity of dry seeds. In Tables 2 to 4 the 100% value demonstrating the catalase activity of dry seeds is not indicated.

Results and Discussion

Catalase activity of almond seeds grouped by tasting is shown in Table 1.

Table 1.

Catalase activity of dry, bitter and bitterish almond seeds in the percentage of that of sweet seeds		
Bitter	Bitterish	Sweet
51.7	70,3	100,0

Definite differences were found in the catalase activity of dry almond seeds grouped according to their content in bitter substance. As shown by the data, there is a correlation between the catalase activity and the content in bitter substance of the seeds. Besides some occasional factors, the main factor accounting for the individual differences in enzyme activity seems to be the concentration of catalase-inhibitors within the seeds, presumably of amygdaline glycoside.

When the almond seeds were soaked, the enzyme activity rapidly decreased and after a slight rise continued to decline (Table 2).

Among the three different temperatures of soakingwater, that of 30 C° proved to be the most favourable. The catalase activity of seeds soaked at 20 and 40 C° was inferior to that of seeds soaked at 30 C°. As shown by the data, in case of prolonged soaking, the unfavourable effect of a temperature ither than the heat optimum of the enzyme at germination, and that of anaerobic conditions appeared together.

Table 2.

Water temperature C°	Percentage of catalase activity, compared to catalase activity of dry seeds				
	Duration of soaking, hours				
	1	8	24	48	72
20	50.2	45.5	38.8	36	33.8
30	53.7	52.4	53.7	54	40.3
40	46.3	45.0	47.8	32	23.8

In cotyledons of germinating almond seeds, a decline of catalase activity appeared at the beginning of germination, too)Table 3).

Table 3.

Percentage of catalase activity, compared to catalase activity of dry seeds					
Number of days since beginning of germination					
1	3	4	6	11	14
40.5	103.9	138.3	250.6	262.5	227.8

Between the 3rd and 11th day of germination, the activity of the enzyme increased as compared to catalase activity of dry seeds. Afterwards, a slowly decreasing tendency was observed.

The catalase activity of germinating sweet and bitter almond seeds is compared in Table 4.

Table 4.

Test material	Percentage of catalase activity compared to catalase activity of dry seeds			
	days since beginning of germ.			
	1	3	5	7
sweet almond	52.5	91.7	130.6	253.6
bitter almond.....	39.4	66.5	96.2	116.6

In bitter almonds, the decrease of activity at the beginning of germination is more important, and the increase in activity takes place at a slower rate than in case of sweet almonds. This phenomenon may be olue to the effect of inhibitors which have an easier access to the enzyme in soaked seeds than in dry ones. The subsequent increase in activity begins presumably after the decomposition of the inhibitors.

Summary and Conclusions

The present paper describes the examination of catalase activity measured in the cotyledons of dry, soaked and germinating almond seeds.

The catalase activity of dry almond seeds of various tastes decreased parallel to the increase in the bitter substance coutent of the seeds.

The decline in catalase activity during the soaking of seeds was affected also by the tenperature of the soakingwater.

During the germination of almond seeds catalase activity increased after an initial decrease, and after the 11th day again showed a declining tendency.

The inhibitory effect exerted by the bitter substance (amygdaline) of the seeds on the activity of catalase manifested itself also in the alteration of enzyme activity during germination.

REFERENCES

1. Frenyó, V. 1962: Neues Verfahren zur Feststellung der Katalase-aktivität von Pflanzen am freien Feld. Ann. Univ. Sci. Budapest. Sect. Biol. 7. 87 – 93.
2. Hori, T. – Nakamuhara, N. 1953. On the relation between the respiratory enzymes and the growth hormones in the seedlings of the leguminosae plants. I. Catalase and peroxidase activities in the Vicia faba seedlings. Szjokubucugaku dzasszi 66. 173 – 176.; 781 – 782.
3. L'Lamas, R. 1954: Modificaciones enzimaticas durante la germinación. Rapp et communs. Hurtiene Congr. Internat. Bot. Paris 11 – 12. 105 – 109.
4. Lubtchenko, V. M. 1959: Aktivnost' katalazy v semenakh Tilia cordata Mill. i Evonymus europaea L. v protsesse stratifikatsii. Bot. Zh. Moscow 64. 522 – 524.